Current analysis development at NCEP/EMC

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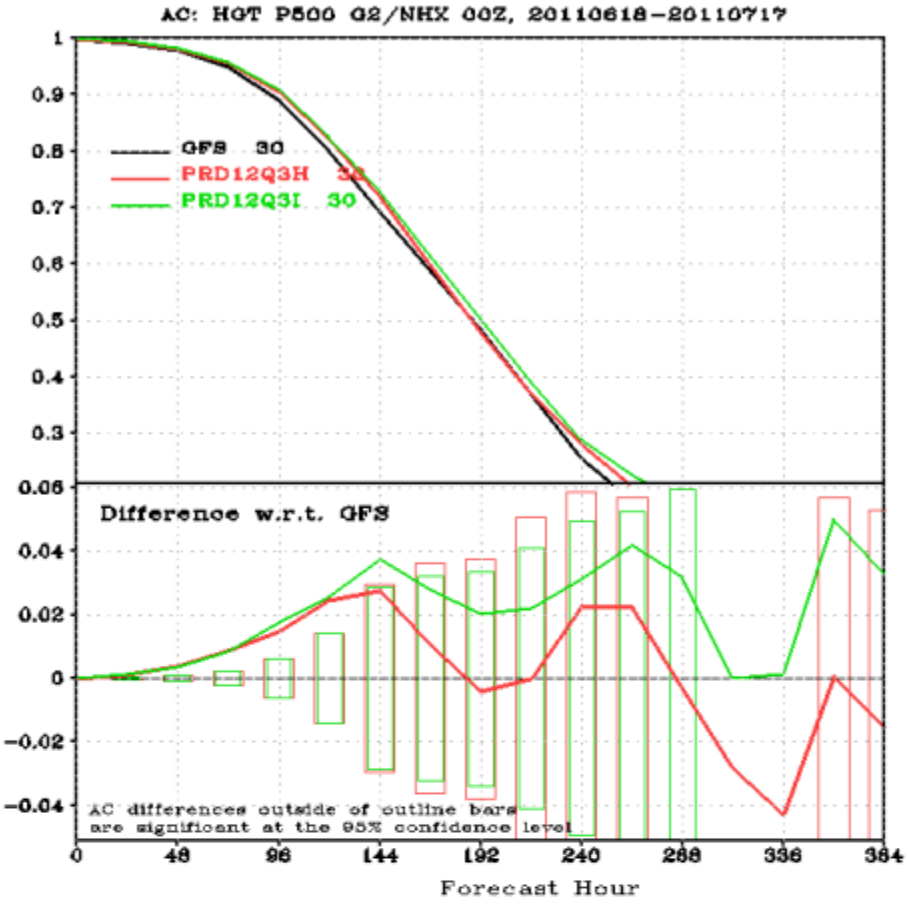
History

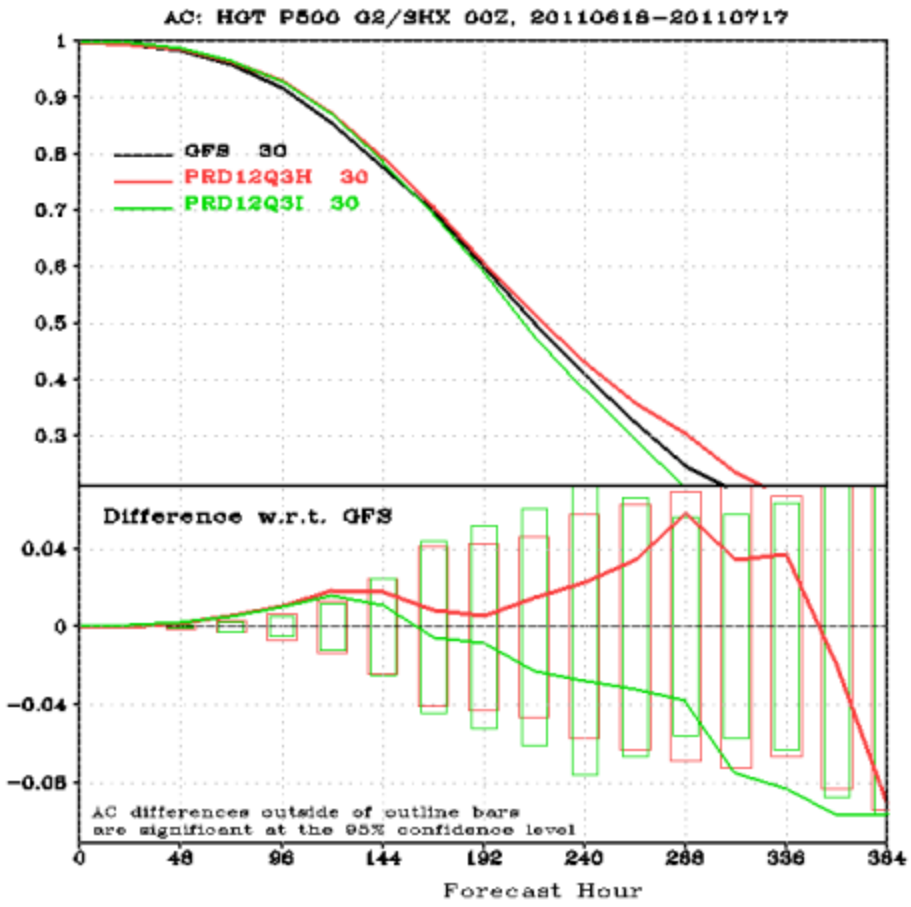
- Historically reanalysis has used a version of an operational NWP data assimilation system
  - Allows use of state-of-the-art data assimilation system
  - Tested over many different situations
  - Allows use of operational data handling infrastructure
  - Development costs greatly reduced

GFS GSI

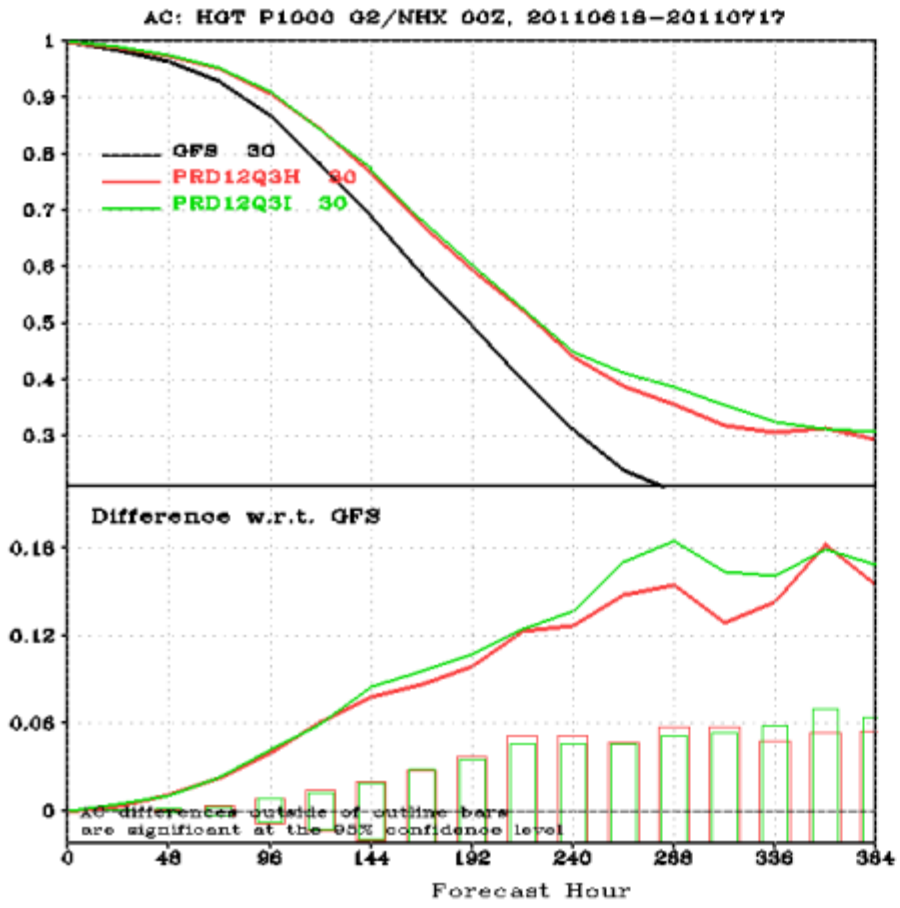
- Current version has evolved from CFSv2.0
  - Infrastructure allows analysis of other variables
  - Inclusion of additional instruments
  - Many smaller enhancements
- Major upgrade being finalized for implementation (Spring 2012)
  - Uses hybrid EnKF/variational assimilation system
  - GPS RO bending angle rather than refractivity

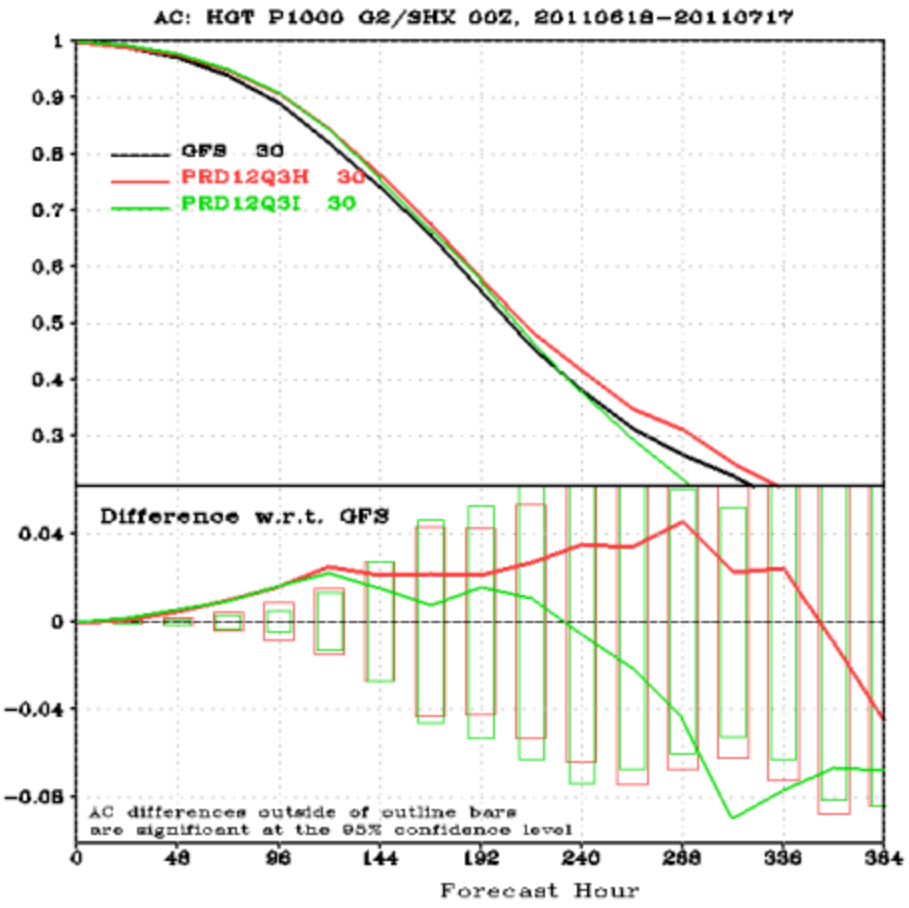
500mb Anomaly Correlation



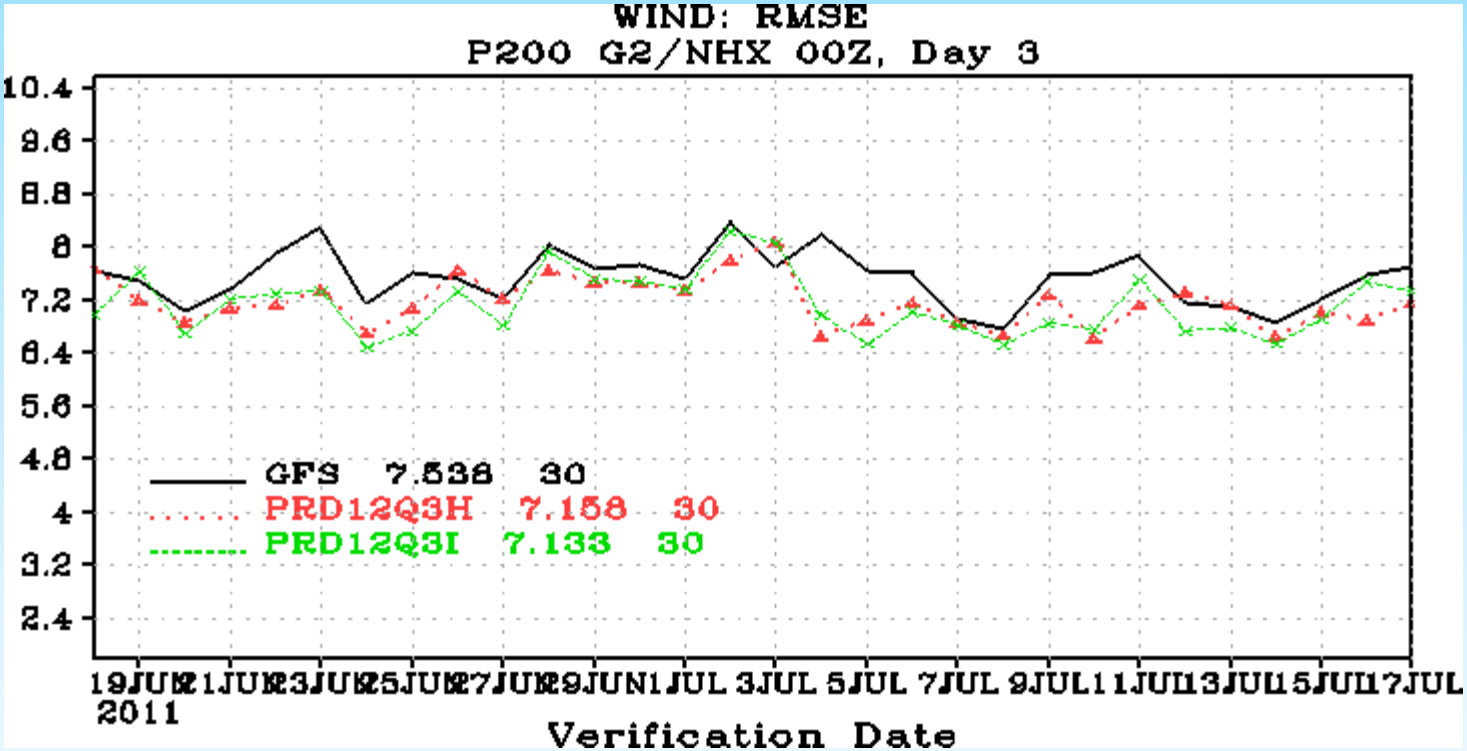


1000mb Anomaly Correlation

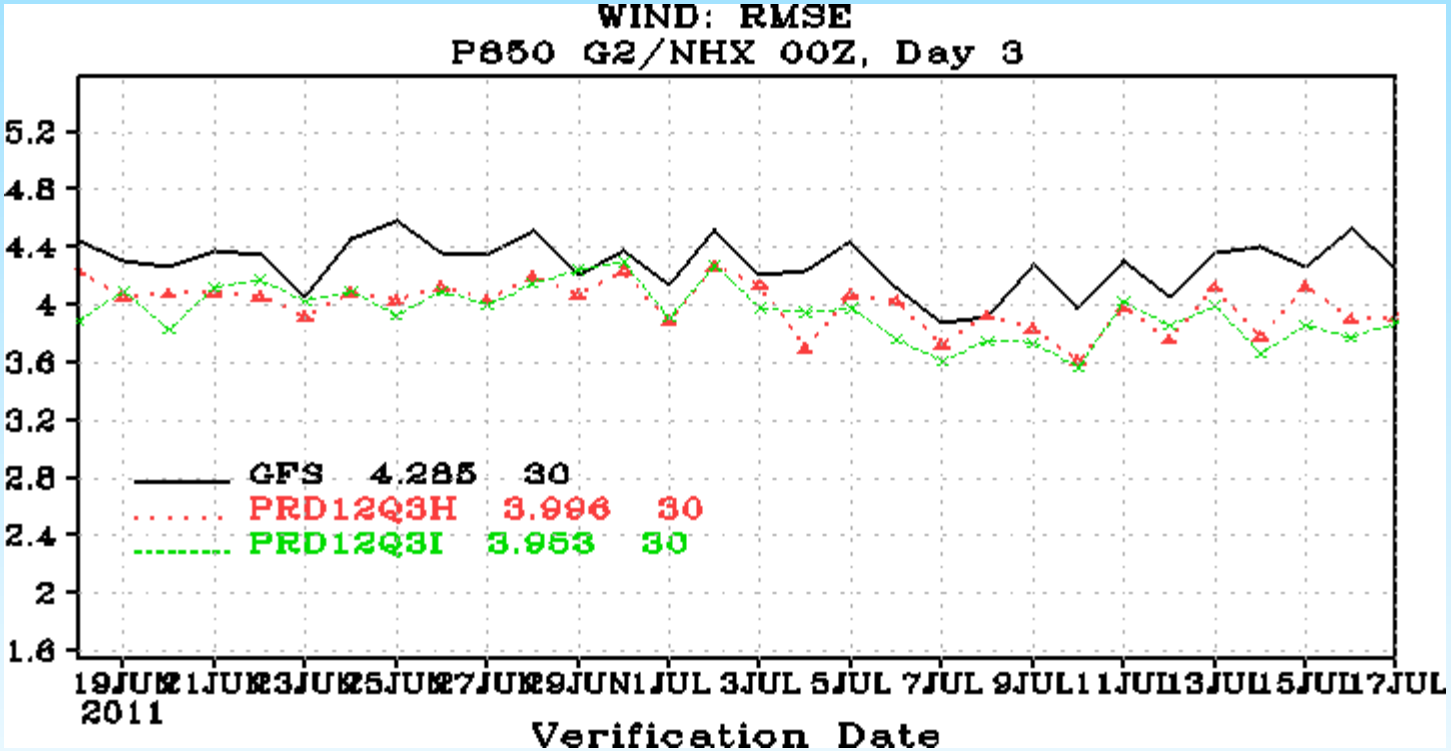




200mb Tropical winds



850mb Tropical winds



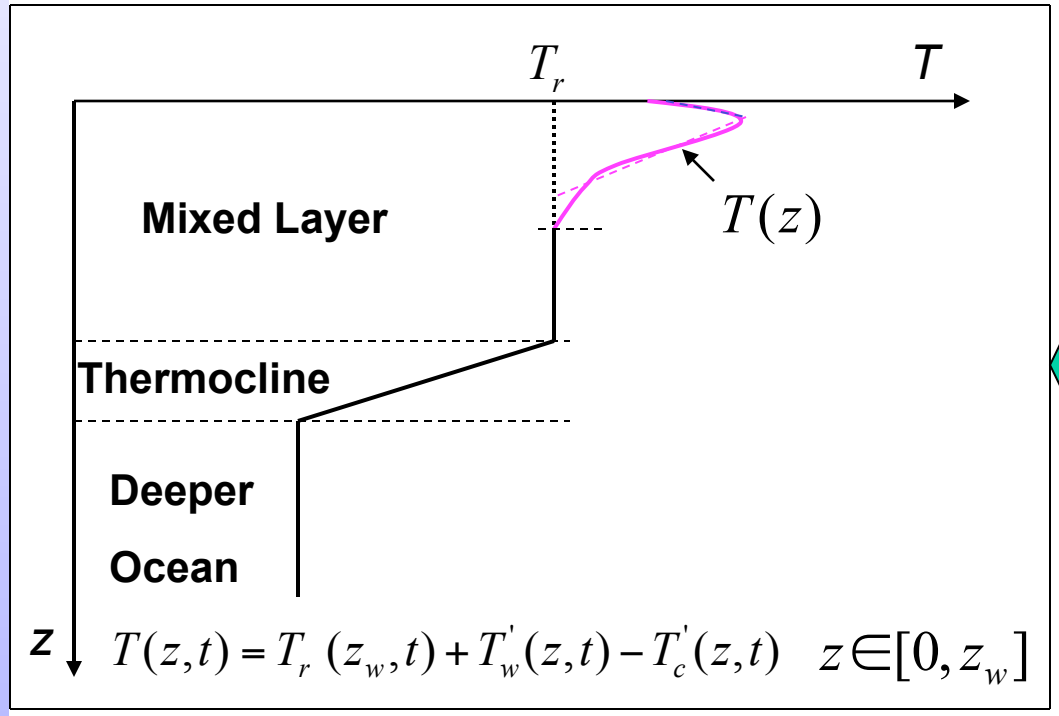
GFS GSI

- Under development
  - NSST analysis and inclusion of NSST model in forecast model
  - Climatological variation in CO_2, CH_4, CO,N_2O
    - Important for radiative transfer and use of radiance data
  - Cloud and precipitation analysis
  - Aerosol and trace gas analysis

What is NSST?

NSST is a **T-Profile** just below the sea surface.

Here, only the vertical thermal structure due to **diurnal thermocline layer warming** and **thermal skin layer cooling** is resolved

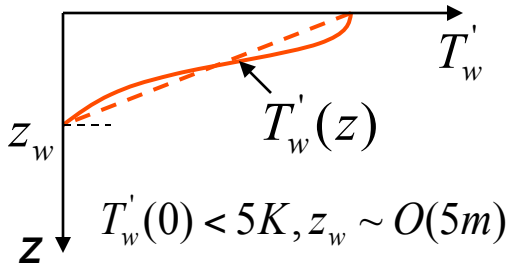


Assuming the linear profiles, then,
5 parameters are enough
to represent **NSST**: $T_r, T_w^{'}(0), z_w, T_c^{'}(0), \delta_c$

Diurnal Warming Profile

$$T_w^{'}(z,t) = [1 - z / z_w(t)]T_w^{'}(0,t)$$

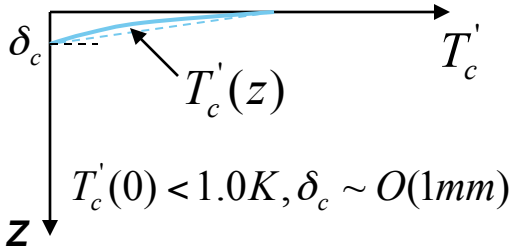
$$T_w^{'}(0,t) = T(0,t) - T(z_w,t) > 0$$



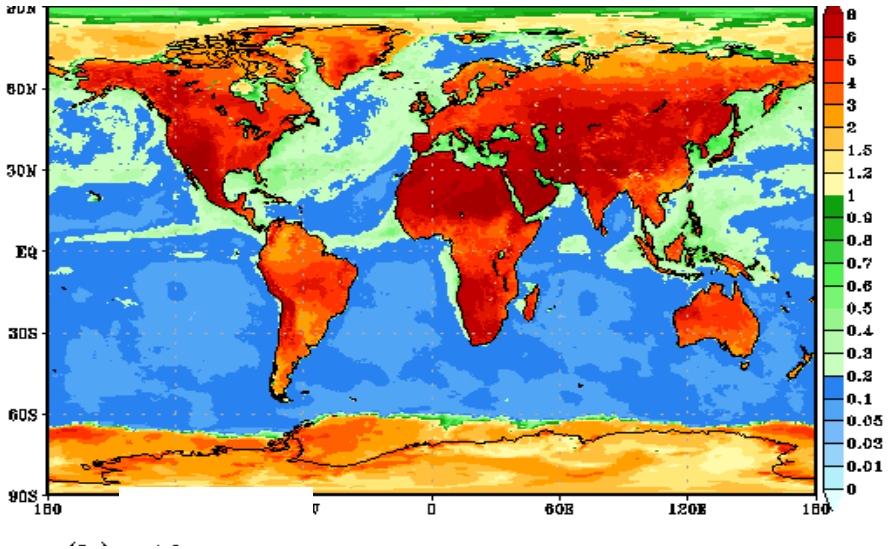
Skin Layer Cooling Profile

$$T_c^{'}(z,t) = [1 - z / \delta_c(t)]T_c^{'}(0,t)$$

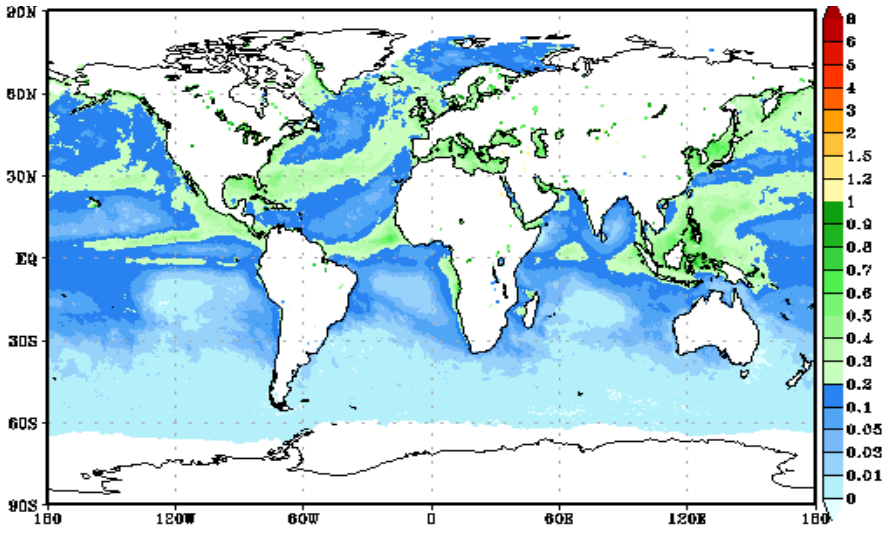
$$T_c^{'}(0) = T(\delta_c) - T(0) > 0$$



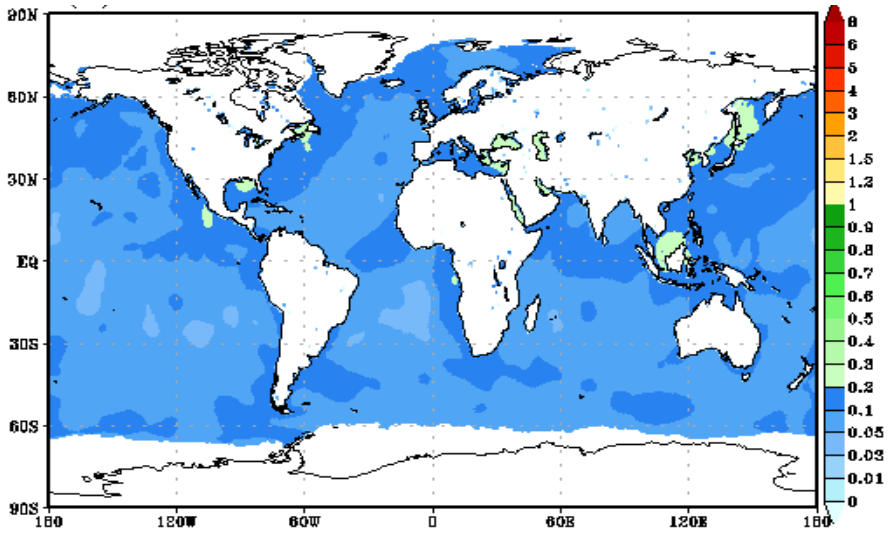
SST: $T_s = T_r + T_w^{'}(0) - T_c^{'}(0)$



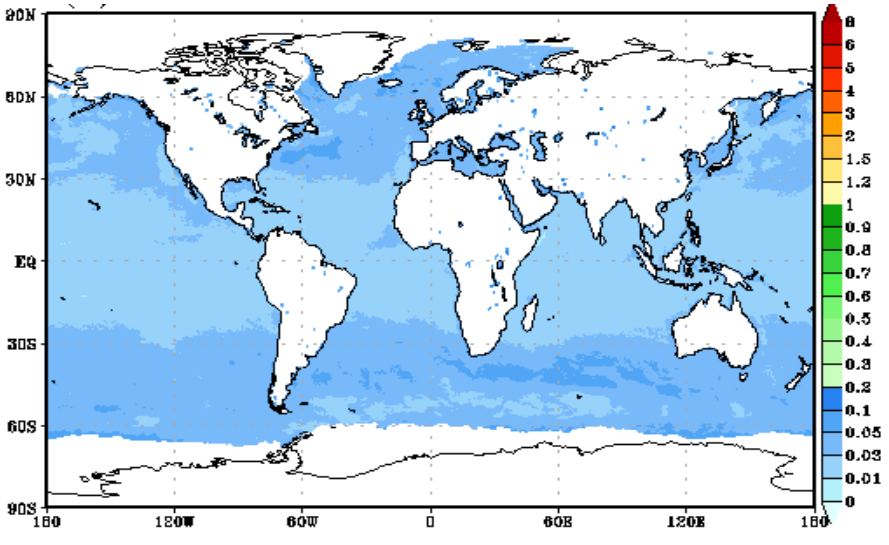
$T_w^{'}(0)$



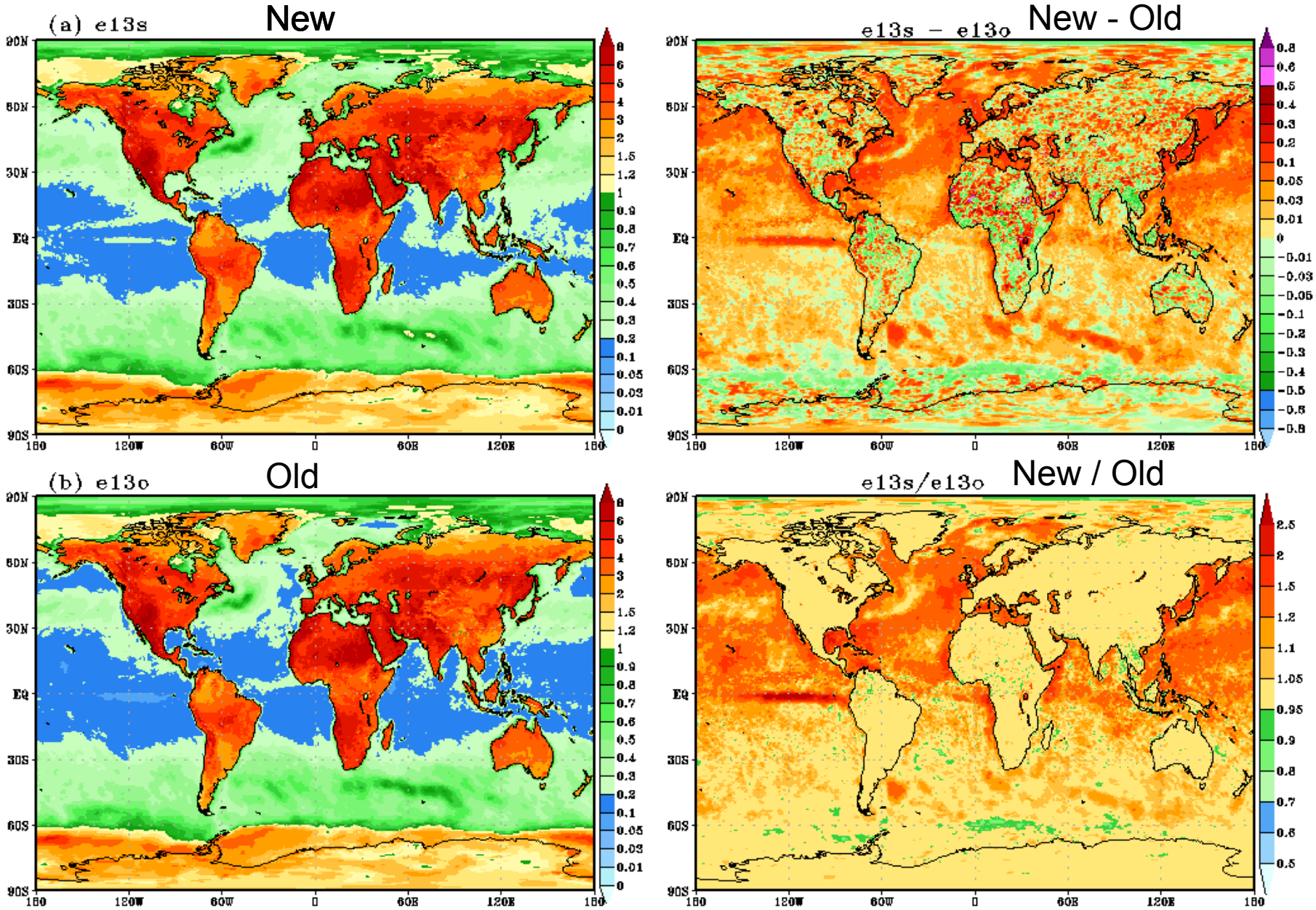
T_r



$T_c^{'}(0)$

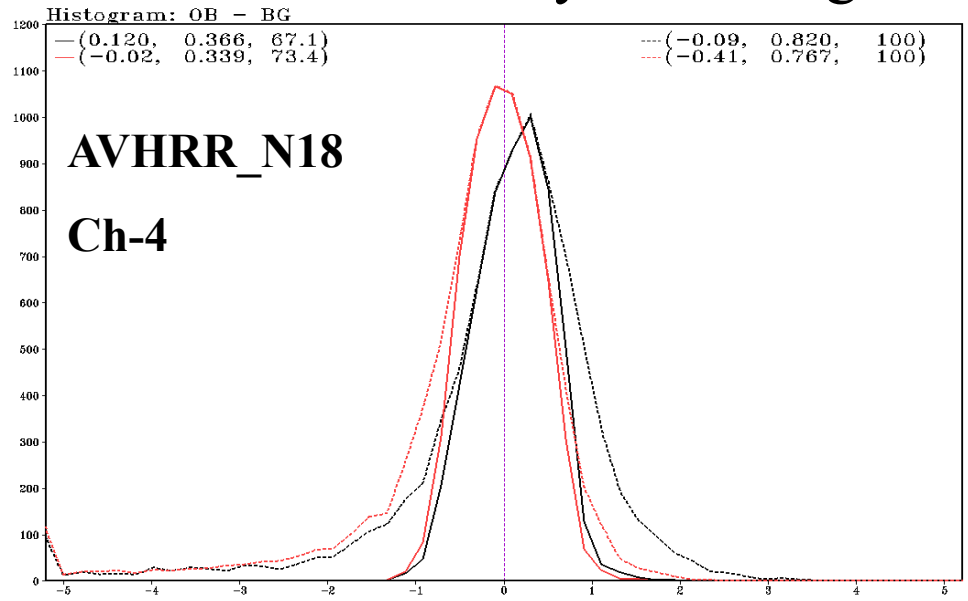


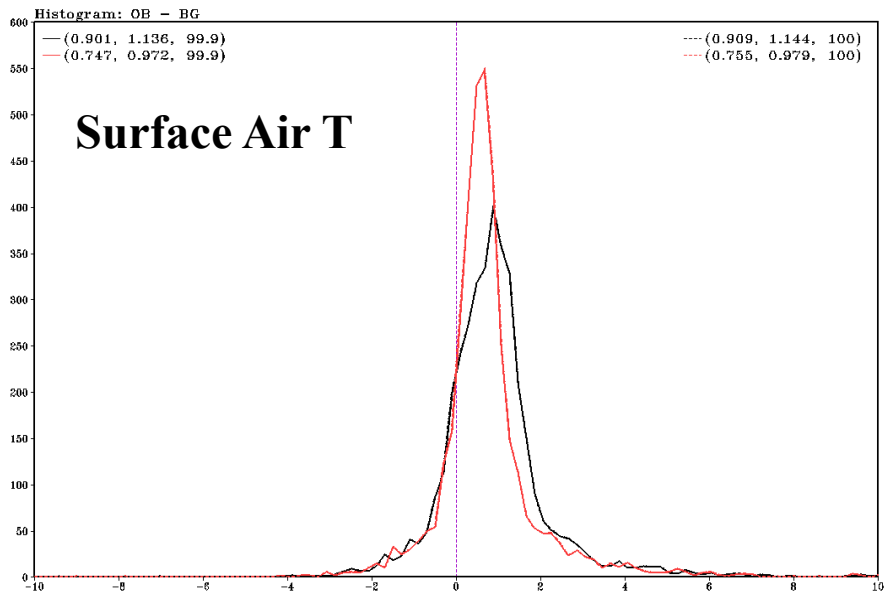
Diurnal Variability of NSST at z=0 (05/17/2010 – 06/24/2010)

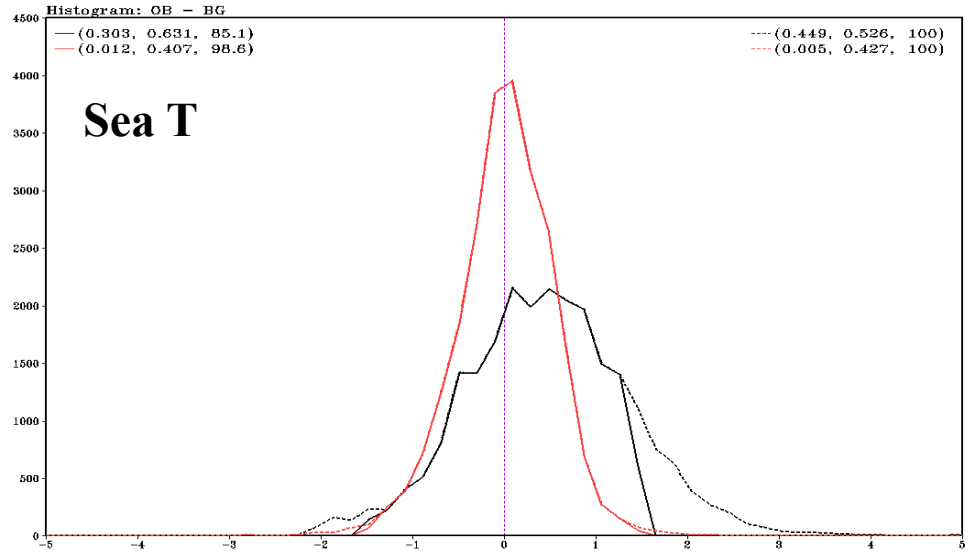


Diurnal Variability of Air temperature (05/17/2010 – 06/24/2010) T_{2m}

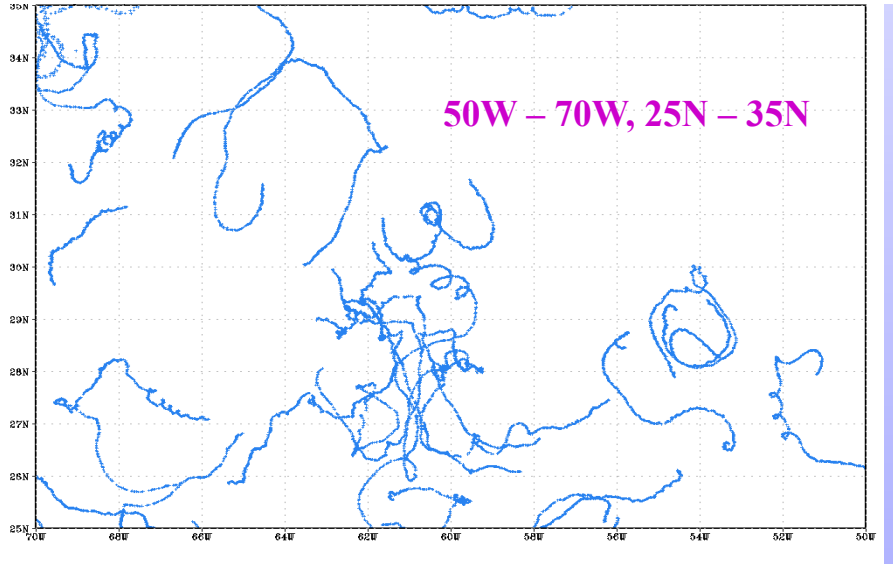
Validation of analysis: Histogram of O-B. 05/12/2010 – 06/24/2010







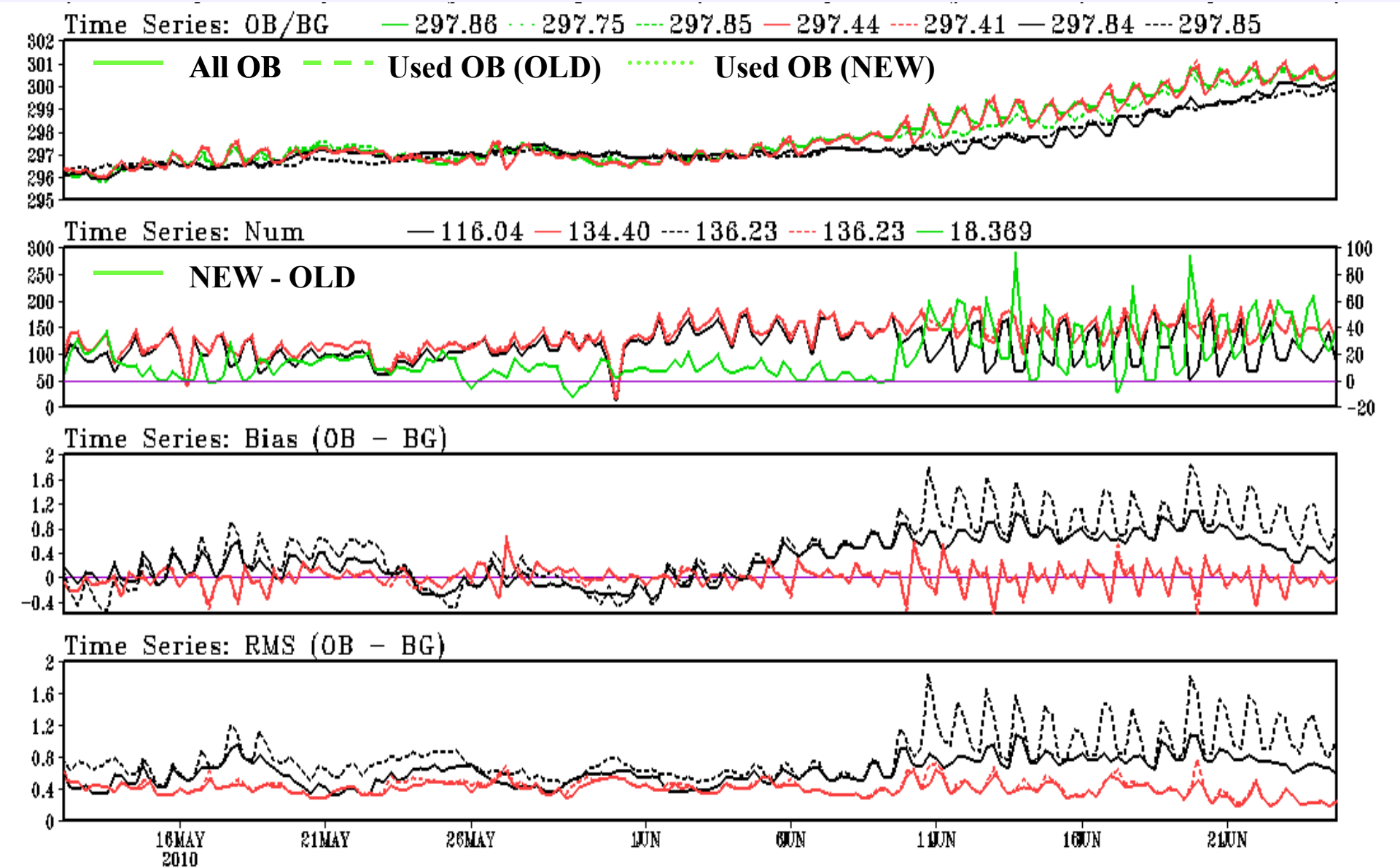
Drifting Buoy Trajectory during these 44 days



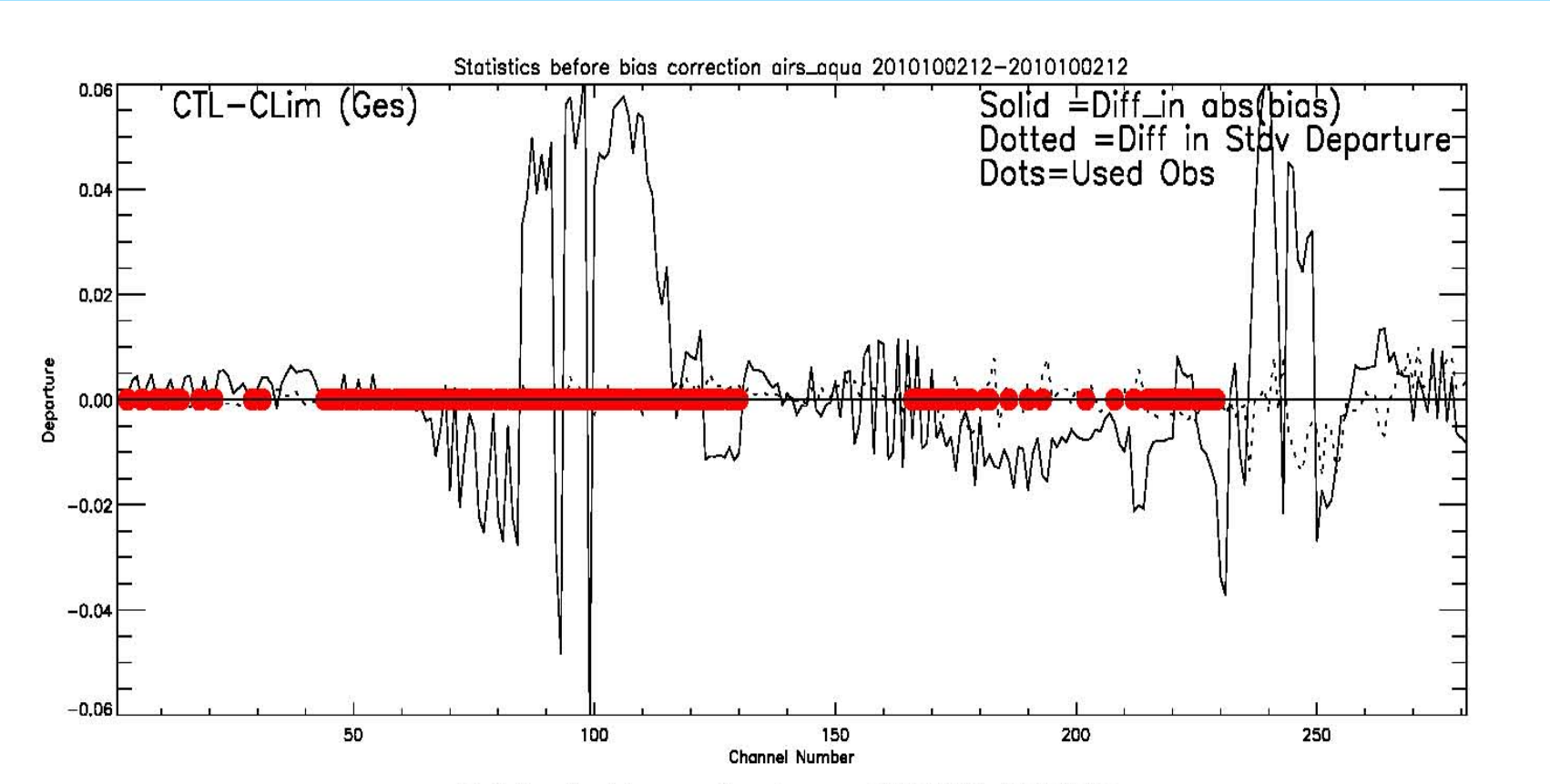
OLD (Used) **OLD (All)** **NEW (Used)** **NEW (All)**

Time series at drifting buoy locations.

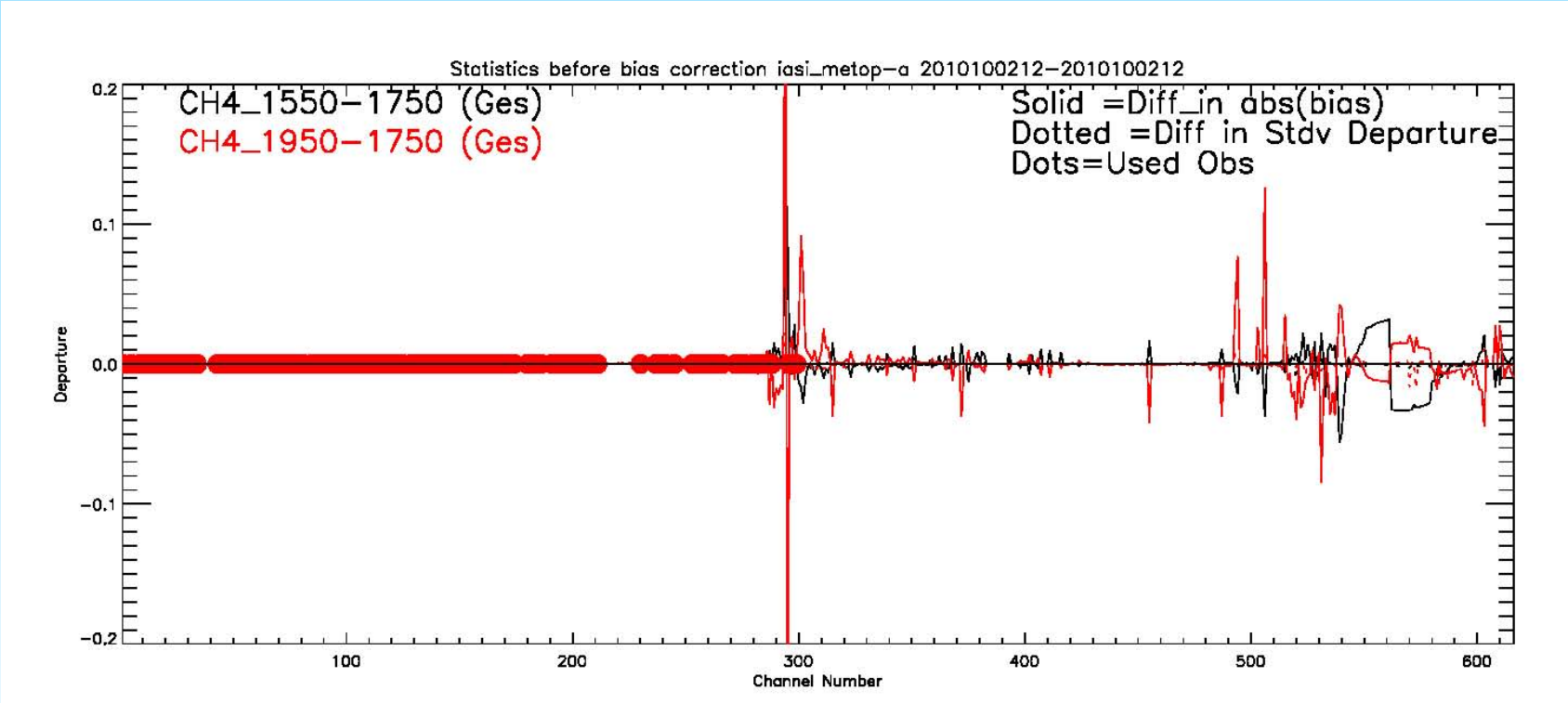
Northern Mid-Latitude Atlantic, 05/12/2010 – 06/24/2010

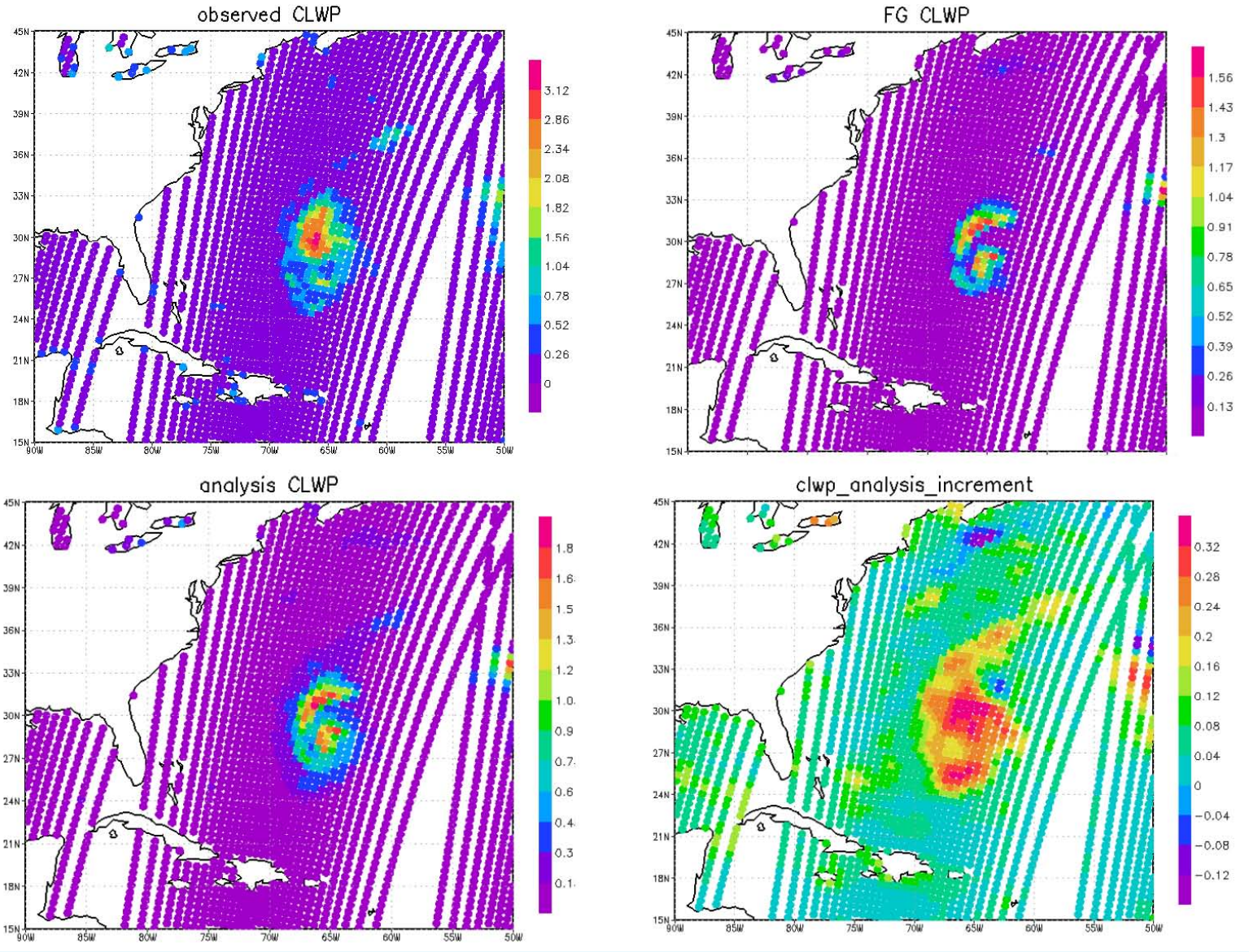


CO2 sensitivity for AIRS



Methane sensitivity for AIRS





25-26 August 2011

CFSv3.0

Final Comments

- Data Mining – should be ongoing – expertise is going away
- Data Handling – messiest part of reanalysis. Who will do this work?
- Data Quality control of data also very important
- Needs ongoing development – NWP-Reanalysis feedback
- Mass-wind-moisture balance very important to get right
- How will you handle model biases?